Design and Implementation of Self-Directed Work Teams in a Pre-Erection Outfitting Department

U.S. DEPARTMENT OF THE NAVY
DAVID TAYLOR RESEARCH CENTER

in cooperation with
National Steel and Shipbuilding Company
San Diego, California

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
DEC 1992	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Design and Implementation of Self-Directed Work Teams in a Pre-Erection Outfitting Department	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Surface Warfare Center CD Code 2230-Design Integration Tools Bldg 192, Room 128 9500 MacArthur Blvd, Bethesda, MD 20817-5700**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**106**	

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NATIONAL SHIPBUILDING RESEARCH PROGRAM

PANEL SP-5

HUMAN RESOURCE INNOVATION

DESIGN AND IMPLEMENTATION OF SELF-DIRECTED WORK TEAMS IN A PRE-ERECTION OUTFITTING DEPARTMENT

December, 1992

In Cooperation With

National Steel & Shipbuilding Company
Harbor Drive & 28th Street
San Diego, California

TaskNo. N5-90-l

ACKNOWLEDGEMENTS

This report was produced for the National Shipbuilding Research Program in order to explore the feasibility of a work team structure in an outfitting department.

The National Shipbuilding Research Program is a joint government and industry program dedicated to improving productivity of U.S. shipbuilding, overhaul, modernization and repair by developing and implementing new methods, technology and equipment. This research project was sponsored by Panel SP-5, Human Resource Innovation, of the Ship Production Committee of the Society of Naval Architects and Marine Engineers.

Susan Salata, Tom Caffo, and Dave Webb, of NASSCO were responsible for project research, development, and presentation. We would like to thank the following people who participated in our surveys and interviews: past and present On-Block Management; On-Block coaches; and work team members. We would also like to express gratitude to the following people for their contribution to the formation and content of the paper: Sandy Ehrlich, Ph. D., of San Diego State University; and Steve Kent, of Bath Iron Works.

EXECUTIVE SUMMARY

This paper discusses the suitability of work teams in a shipbuilding pre-erection outfitting area. Of special interest is NASSCO'S attempt at implementing work teams in their pre-election outfitting area, the On-Block Department. Although the On-Block work teams were disbanded, they could be implemented again provided the company is ready for them. Therefore, recommendations for a more effective design and implementation of work teams in the On-Block Department are given.

A work team is a group of people who coordinate dependant tasks with one another in order to reach a collective goal. Common characteristics of work teams include: responsibility for completing a relatively whole task; members who possess a variety of skills relevant to the group task; empowerment to make such decisions as methods of work, task schedules, and assignment of members to different tasks; responsibility to control and improve their work process, and the acquisition of new training as necessary.

Designing and implementing work teams is a difficult task. There are many factors that must be carefully evaluated in a work team design and implementation. The following describes these factors and how they relate to NASSCO'S approach to work team design and implementation.

Vision

The company must create a vision which includes the long term business goals of the company and compatibility with work teams. The vision must be communicated and reinforced throughout the company. Although NASSCO had a vision for the work team implementation, the coaches and team members did not feel as though they were given clear goals. Therefore, if there is a commitment to try work teams again, management should take an active role in the work team design and implementation. This includes learning about work teams and forming a steering committee to guide the work team implementation.

Analysis of the Work Structure

The work structure that will be converted to work teams must be reviewed in order *to* optimize the reorganization. A thorough socio-technical analysis can first determine if work teams are appropriate and secondly, assist in the redesign if indeed work teams are suitable. A socio-technical analysis involves reviewing the work processes and technology by identifying major tasks and their outputs, and key variances that could prevent the completion of the major tasks. The analysis also includes mapping out each employee's role. After assessing all of the social and technical factors that make up the work process, a work team design can be devised that optimizes the integration of the social and technical factors. NASSCO'S work team design integrated the social and technical systems in On-Block well. However, even though On-Block management identified key variances that could disrupt the outfitting process, there was no provision to control these variances in the work team design. For example, although material

arriving late was identified as a key variance, no system or procedure was implemented in order to prevent or minimize material arriving late.

In order to benefit from a socio-technical analysis, NASSCO must take action to minimize the affect of variances that are identified. Also, the restructuring to work teams must provide the teams with enough flexibility to handle fluctuations in their work environment. On-Block needs a team structure that maintains the high trade skill level of the members as well as provides the amount of cross training needed for flexibility.

Boundary Management

Boundary management involves controlling exchanges between the teams and the environment. Effective boundary control greatly reduces the amount of work interruptions. This function should be established prior to the start of work teams so the teams can concentrate on their work rather than technical difficulties such as poor quality of material and outfitting interferences. With boundary control, these types of technical problems would be identified and resolved prior to entering the work system. This is a major function that was not considered in NASSCO'S work team implementation. The work teams had numerous disruptions due to lack of boundary management. Their blueprints had errors, many engineering changes interrupted their work flow, and often, the materials they received were incorrect or damaged. All of these problems should have been fixed before they were allowed to enter On-Block and interfere with the work process of the work teams. In order for work teams to operate again, NASSCO would have to first establish policies and procedures for minimizing the work teams' disruptions.

For example, the quality of outfitting items that the teams install can be regulated if On-Block's internal suppliers instituted process control.

Coaching

The coach's role is the most instrumental in a work team implementation. The teams need a coach in order to guide them through the transition, set clear guidelines, assist team members in acquiring necessary skills, and perform boundary management functions. It is important that the coaches maintain a supervisory role at the onset and only relinquish responsibilities to the team when the team members are ready. Unfortunately, NASSCO'S coaches did not have well defined roles. They felt that their roles were ambiguous and confusing so they were less effective at facilitating the implementation than they could have been. In addition, they immediately gave autonomy to the teams. This made the implementation unorganized and confusing for the teams. The coach's role must be well defined up front. Then, the coaches need education on the vision of the company as well as their role in the implementation, therefore enabling a smooth and well organized transition to work teams.

Training

A comprehensive and continual training plan must be part of the work team design. Work team members will need training in 3 skill areas: job; team/interaction; and quality/action. Training should be accomplished close to the time when the teams will be required to apply the skills. Coaches need extensive training in order to make the transition to their new role and guide the teams through the implementation. Support department

personnel also require training in order to meet the needs of the teams. Training is an area where NASSCO did not devote adequate resources. The teams, coaches, and support personnel lacked the proper training in order to gain the full benefits of a work team structure. The teams were not cross-trained to the extent that was planned, the coaches were not prepared for their role, and the support personnel did not have the knowledge to play an instrumental role in the work team implementation. Training is an area where substantial resources must be allocated. Without a strong commitment to training, work teams should not be re-implemented.

Team Composition

First of all, the teams must be comprised of members who possess the technical skills needed in order to complete the work. Secondly, cohesiveness needs to be achieved. Both communication and cohesiveness increase when team members can acquire and/or comprehend all of the skills. The On-Block work teams encountered problems in these areas. Since the tradespeople were not effectively cross trained, the technical skills of the team members did not always match the requirements for the blocks that they had to outfit. For example, there was minimal work for certain team members, such as electricians and sheetmetal fitters, on blocks early in the contract. This reduced team cohesiveness and productivity. The teams' productivity was also affected when trainees were added to the teams. These new members needed substantial assistance from the original team members. A work team implementation in On-Block must have strategies for handling trade requirement variations on the blocks and acquiring new members such as trainees. Restructuring the department into work stations that outfit similar blocks

could minimize the trade requirement variations for each team. This would allow the teams to be more productive as well as cohesive.

Due to the complexity of the work in On-Block, the company can benefit from the use of work teams. Work teams can improve the coordination and efficiency of elaborate, dependant tasks provided that the design and implementation are thorough.

INTRODUCTION

In recent years, self-directed work teams have been used by companies striving for continuous improvement. They are "one of the most advanced forms of employee involvement and potentially one of the most productive (Wellins, Wilson, Katz, Laughlin, Day, & Price, 1990, p.26)." With these objectives in mind, National Steel and Shipbuilding Company (NASSCO) implemented work teams in their pre-erection outfitting department (the On-Block Department) in the late 1980's. Unfotunately, some factors in the implementation were neither well designed nor planned. After only 13 months, the On-Block Department had to revert back to a traditional trade structure. NASSCO learned a great deal about their organization and the environment necessary for work teams from the experience. The purpose of this paper is to outline the theory behind work teams, discuss work team design and implementation strategies, analyze NASSCO'S work team implementation and provide recommendations for implementing work teams in a shipbuilding environment.

Work Teams as Socio-Technical Systems

In a self-directed work team, the team is empowered to regulate its own behavior around whole tasks. There are three major advantages to this type of work structure:

1) Overall task integration is accomplished by grouping interdependent tasks into a single work system.
2) Quick responses to fluctuations in group performance are possible due to

internal control by the group.

3) Workers can gain satisfaction by mastering their work environment through both task integration and internal control (Cummings and Molloy, 1977).

According to a survey of over 200 executives, the most frequently cited benefits of work teams were as follows:

1) Improved team involvement and performance.
2) Positive morale.
3) Sense of ownership and commitment.
4) Self-improvement/Realization of talents.
5) Improved quality.
6) Customer focus/increased customer satisfaction.

Since the implementation of work teams in 1986, the Lord Corporation' Aerospace Division has realized the following improvements:

1) Manufacturing lead times reduced 50% - 90%.
2) Reject rate (parts per minute) reduced 95%.
3) Scrap cost reduced 85%.
4) Productivity increased 30%.
5) Absenteeism reduced 75%.
6) No lost time accidents in the last 4 years.

The Lord Corporation Aerospace Division in Dayton Ohio employees 65 people and produces fixed wing aircraft engine mounting systems.

The self-directed work team concept was derived from socio-technical systems theory and design. Socio-technical systems theory focuses on the interdependencies between people, technology and the environment. This theory proposes that there are two components of a work process: a technological system and a social system. The technological system is the equipment and methods of operations used to transform raw materials into products. The social system is the work structure that relates people to the technology and to each other. In order to maintain performance, a socio-technical system must not only regulate its overall behavior, but it must also control the behavior of the social and technological components (Cummings, 1978).

Another function of a socio-technical system is to relate to its work environment and cope with fluctuations within it. Environmental fluctuations include inconsistent vendor quality, engineering and schedule changes. There are several mechanisms for a socio-technical system to regulate itself during fluctuations in the work environment: task definition, flexibility, boundary control, and feedback systems. In addition, a socio-technical system can simplify a complex environment for improved control. The following describes these self-regulating mechanisms:

Task Definition

Members of the group must agree on the primary task. They can then identify areas of the environment with which the system must interact.

Flexibility

Flexibility of the system's internal resources is necessary to maintain itself during environmental changes. The system adjusts social and technical resources according to environmental variations.

Boundary Control

Boundary control is needed to regulate exchanges entering and leaving the work system. The amount of regulation needed depends on the flexibility and capabilities of the socio-technical system (Cummings & Srivastva, 1977).

Feedback Systems

Feedback is needed so that the system knows how it is performing relative to a standard. Then, if necessary, it can adjust accordingly.

Simplification

Complex environments can exist when there is a fast rate of change and a high degree of interconnections between the work system and the environment. Two major problems occur:

1) Predictions of disturbances can not be made far in advance in order to take counteractive measures.
2) Causes of disturbances are difficult to determine.

These problems cause the system to be reactive and ineffective. A solution is to simplify

the environment, enabling the system to control those factors in the environment with which it must react (Cummings &Srivastva, 1977).

After understanding socio-technical systems theory, organizations can design work structures that are responsive to the task requirements of the technology and the social and psychological needs of their employees. Then, the work structure will be both productive and satisfying for employees (Cummings, 1978).

Designing Socio-Technical Systems

The intent of work design is to reduce variance in the work system and improve the prospect of goal attainment. Two forms of control can be used: External mechanisms or increased internal control of the group. External mechanisms refer to hierarchial supervision, scheduling and standardization. Conversely, internal control of the group can be increased by giving the employees the power for self-regulation. External control is best suited for simple work systems that do not face uncertainty. This method of control becomes less effective when a work system faces uncertain exchanges with the environment (e.g., scheduling changes) or conversion uncertainty (incomplete technical knowledge about how to produce a certain outcome). Regulating environmental exchanges and conversion can be more effectively performed by the employees who are closer to the sources of uncertainty. Therefore, increased internal control is the preferred regulatory method for work systems with a high degree of uncertainty (Cummings, 1978). One method increasing internal control is to empower employees through the development of self-regulating work teams.

Implementing Self-Directed Work Teams

Self-directed work teams are a major organizational change from a traditional hierarchical work structure and they must be implemented carefully. According to Wellins, Byham and *Wilson* (1991), there are four phases to fully design and implement work teams: vision, design, implementation, and monitoring.

Vision

Senior management first creates a new vision, considering the following: The long term business goals of the company, how clear the organizational vision is to employees and how compatible the vision is with empowered teams. Then, they need to form a steering committee to assess the feasibility of using work teams in the organization.

Long Term Business Goals: "Some organizations start teams because they're a hot new trend, because teams are working at the company next door, or because the competition is trying it. However, these reasons are insufficient. Teams are not ends in themselves; they are a means by which to achieve other organizational goals (Wellins et al., 1991, p.83)." When defining the organizational goals, the following environmental factors must be examined: competitive pressures, changing customer demands, regulatory influences, and potential new product developments. Once the organizational goals have been determined, all levels of management must agree on goals and expectations for the teams. Management should ask each other the following questions:

1) What quantitative improvements (quality, rework, cycle time, etc.) are expected with the use of teams?

2) What is the present level of these indices and how much empowerment is currently felt by individuals?

3) What qualitative improvements (morale, turnover, absenteeism, etc.) can be expected?

4) What is the estimated investment required to implement and maintain work teams?

The anticipated beneftis must be compared to the expected cost in order to determine whether changing to teams would be cost effective. Both direct costs (facility design, training programs, etc.) and indirect costs (meetings, training, etc.) must be considered. Quite often, companies have inflated expectations of work teams based on success stories featured in business literature. In reality, productivity tends to decrease initially before any improvements are realized. This is due to the disruption caused by the organizational change. According to Jerry Ledford, Research Scientist at the University of Southern California, it could take a year or more before any benefits from work teams are realized.

Organizational Vision and Values: Defining vision and values is a fundamental step in creating an empowered culture. If the organization does not have a clear vision, upper management must create one. Senior management must ensure that the vision and values are both conducive to empowered teams and are clearly understood by the employees. One way of reinforcing the vision is to refer to it when making business

decisions. Senior management must also review the organizational systems and processes to make sure that they are congruent with the values. After management has communicated the organizational mission, they need to form a steering committee to further analyze the suitability of work teams for the organization.

Steering Committee Selection and Role: Some of the people who should be considered as members due to their function in the organization include: The senior managers of the area which will have the worK teams, union leaders, functional managers (e.g., purchasing, engineering) and first line supervisors who would be affected by the change. According to Orsburn et al. (1990), a consultant can be a valuable resource to work with the committee and help them in areas outside their expertise.

When the selection of the steering committee is complete, the education of its members on the work team philosophy should begin. Members should invite experts on work teams to their company for short seminars, make site visits to companies that have work teams, and become familiar with the literature on teams. The steering committee also needs to evaluate the organization's compatibility with a work team structure. Wellins et al., (1991) devised the *Team Readiness Survey* to perform this review. The *Team Readiness Suvey* in Appendix 1. is a tool that assesses the organizational culture as well as the compatibility of management and employee attitudes with empowerment. In addition, the survey evaluates the technical and social needs of the work system. An organization that scores high on the survey is ready to implement work teams. Lower scores indicate that there are policy, process and procedural problems that need to be

resolved before attempting work teams. Low scores on any of the survey questions should be investigated so that the problems can be resolved. Usually, once the steering committee is convinced that the implementation of work teams will be beneficial to the company, and that the company is ready for the change, they develop a design team. The design team's function includes the detail planning and ensuring the smooth implementation of work teams. At this point, the function of the steering committee is to provide the vision, direction, and support for the design team.

Work Team Design

The function of the design team is to analyze and redesign the current work system, plan and implement work teams, as well as monitor the results of the implementation. Usually, a design team is comprised of some members from the steering committee, supervisors and likely team members from the area implementing teams, union officials, human resource representatives and functional experts from support departments such as Engineering and Purchasing. The intent of having both a steering committee and a design team is to involve as many stakeholders as possible. 'The more all stakeholders are involved in the design and implementation process, the more likely it is that your teams will be successful (Wellins et al., 1991, p.105)."

The first step for the design team is to prepare a socio-technical analysis of the work structure. The work team design must optimize both the social and technical systems as well as create a sound relationship between the work process and the environment.

Technical System Analysis: The design team analyzes the work process and technology by first identifying the major tasks and their desired outputs. Secondly, the Knds of tasks identified are evaluated. Usually, it is not worthwhile to implement work teams if the tasks are independent since *a* high degree of cooperation and coordination is not required. Unlike independent tasks, dependent tasks require cooperation between employees. Dependent tasks can be successive interdependent or simultaneous interdependent. Successive interdependent tasks involve tasks that are performed in sequence. Simultaneous interdependent tasks are performed by employees working together in order to complete a larger task (Cummings & Srivastva, 1977). These types of tasks require the high degree of employee coordination that work teams can provide. Thirdly, each operation is reviewed to determine if it is a value or non-value added task. If a task does not significantly contribute to meeting the customer's demands, then it should be redesigned or eliminated (Wellins et al., 1991). An example of non-value activity is multiple forklift moves of material into storage. Moving material around does not add value to the product unless the material needs to be moved from one process to the next. Fourthly, after the non-value tasks are discarded, the team identifies key variances that could disrupt the desired output. A key variance is a potential work flow disturbance such as missing material. After the potential variances are identified, the design team can structure the work teams in away that controls the key variances. For example, the work team design could call for the material control function to be handled within the team. The design team also needs to be aware of the union contract constraints when designing member roles and responsibilities.

Social System Analysis: The purpose of the social analysis is to create meaningful jobs. First, the design team maps out each team member's role. They also identify the supervisor's tasks to determine which responsibilities the work team will adopt initially (more of the supervisor's duties can be transferred to the team as they become more confident and proficient). Then, the design team reviews the functions of the support departments (maintenance, engineering, human resources, safety, training, inventory, etc.) for responsibilities that the work teams can adopt. The work teams can take on some of these support duties as permanent or rotating assignments. A permanent assignment could be given to a support person on the team. For example, a material support technician could order material and control inventory. Rotating roles would eventually be assigned to ail members so they can learn every aspect of managing their work process. For example, the teams may take turns performing preventative maintenance on their equipment while the maintenance department would still repair broken equipment. It is important that the new roles of the team members, supervisors, and support personnel are communicated up front so every vital function is covered and there is a consensus.At Weyerhauser Company, a paper mill in Grayling Michigan, the work teams have assumed involvement in human resources. The teams participate in employee selection and evaluations as well as benefti determination. With the help of the work teams, Weyerhauser has devised a creative way to control the health care *costs* that the company pays on behalf of the employees. Rather than cut employee benefits, all employees and their families attend classes on how *to* keep health care costs down. If the families can control the costs, then there will be no health care benefit reduction. The

social design should also include some member assignment of duties that were previously performed by supervisors and/or support departments.

Tennessee Eastman Company's Dope Department redesigned their work process for self-directed work teams in 1991 by using a socio-technical analysis. The Dope Department is part of Tennessee Eastman's Filter Products Division. The social system analysis of the Dope Department involved surveying other departments in the company to learn the following:

1) Quality of support from the Dope Department.
2) Quality of communication with the Dope Department.
3) Extent of teamwork with the Dope Department.

By using the results of the survey, the Dope Department eliminated unnecessary duties and created some roles that were needed. This enabled them to incorporate improvements into their social design.

Next, the design team integrates their social and technical analyses and designs an optimal structure. "The desired results are that teams identify and control variances at their source, coordinate work at the lowest appropriate level, and obtain support from the larger organization's systems (Wellins et al., 1991, p.113)." The major factors that must be addressed in the optimization are as follows: clearly differentiated task boundary, boundary management, task control, team composition, organizational supports, and expert coaching.

Clearly Differentiated Task Boundary: The work team should have a whole task separated from other organizational units (Cummings, 1978). The team's task should result in a clearly defined outcome specified in terms of quantity and quality of a product (Herbst, 1956). Then, the technical variances can be contained within the team's boundaries and therefore controlled by the group (Cummings, 1978). In order to further aid the group in separating their work process from the larger organization, it is useful to incorporate their physical location needs in the design (Wellins et al., 1991).

Boundary Management: Team members should have some influence over transactions with their task environment. With this influence, they will not be so reliant on outside regulators such as quality assurance inspectors. First of all, the work process should have a clearly defined task boundary. Then, boundary control roles must be defined in order for the work team to maintain stability. Boundary management serves two **functions:** to protect the work system from external disruptions and to regulate exchanges with the environment (inputs and outputs).

Protecting the work process from external influences is the key responsibility of boundary management. This protection helps the team to maintain more control over their work process (Cummings & Srivastva, 1977). Establishing team work and commitment from the other departments in the company can protect the team from environmental disturbances. For example, if the Engineering Standards group needs to revise a portion of the pipe hanger standard, the impact on the work teams will be minimized if the teams

are allowed to participate in the revision process and agree on the terminology of thte standard. If delegated members of the work teams participate up front, they can immediately notify the rest of their team of the changes and take action to make the necessary adjustments to their work process. This would reduce the amount of rework that the change in the pipe hanger standard may have caused if the teams had to wait for the official revision and did not understand the terminology of the standard. This kind of protective strategy can help the team make timely adjustments to their work process during environmental changes.

Regulating environmental exchanges is needed to maintain stability in the system during exchanges of inputs (e.g., raw materials, and components) and outputs (e.g., finished product). This is most effectively accomplished when the boundary control activities are placed at the import and export sides of the work system. For example, an inspection of incoming components at the boundary of a work system can reject defective parts before they are allowed to enter the system and disrupt the work process. According to Cummings and Srivastva (1977), these boundary control units must have the following characteristics for successful regulation:

1) A set of standards to objectively determine whether materials or information may enter or exit the system. The objective of the standards is to ensure the correct operation of the system. The standards can cover quality, “rates, kinds and costs of imports and exports (p.11).”

2) A method for inspecting inputs and outputs in order to compare them to the standards of acceptability such as purchasing specifications and government standards.

3) A list of corrective behaviors for rectifying deviations from the standards. Corrective responses include rejecting imports or exports, or modifying them to meet standards.

4) The boundary control units must be allowed to make timely decisions so that a corrective course of action can be taken before the disturbance impacts the system. For example, sub-standard raw materials must be rectified before they enter the system.

Both boundary protection and control enable the team to stabilize the work process.

Task Control: The team members need the ability to regulate their work process. This can be accomplished by giving the group autonomy within the realm of company goals and direction. The work teams would have the autonomy to choose work methods and activities that match the task and environmental demands (Herbst, 1962), as well as the freedom to set and reset goals as emergent situations arise (e.g., equipment breakdowns and stressful periods) (Emery, 1959). In addition, the work team needs performance feedback so the group can regulate their behavior toward their goals.

Team Composition: The first consideration of team composition is group size. Rice (1958) *suggests* that the team size should be "the smallest number that can perform a 'whole' task and can satisfy the social and psychological needs of its members (P.36)." The second consideration is member selection. Not only must individuals be evaluated on their technical skills related to the task, but on their ability to learn new technical and social skills. Trist and Murray (1958) found that "group stability is more easily maintained when the range of skills required of the group members is such that all members of the group can comprehend all the skills, and without necessarily having or wanting to have them, could aspire to their acquisition (pp.37-38)." Communication and group cohesiveness decreases when there are differences in the skills between group members. Another selection factor is motivation. Some people may not be motivated by working within a work team. Lorsch and Morse (1974) propose that personality characteristics determine what kind of work is motivating to an individual. The personality characteristics that are most conducive to being motivated by empowerment are the individual's preferences toward a less controlling authority/environment, working in a group, problem solving, and cognitive complexity. A person with these preferences is usually motivated by work that is more autonomous, and complex. Motivation arises from intrinsic rewards the individual receives from mastering his/her environment. These are the types of individuals that make the most appropriate team members.

Organizational Supports: Although the work team is designed to work independently, they do have to interact with the organization. The company needs to support the teams

with human resource functions such as congruent compensation and education systems. There are various alternative compensation systems. One example is a pay for knowledge system that provides rewards for members to gain more skills. Another example is a compensation system that provides incentives for collaborating with the team rather than encouraging individual recognition behavior. The education system should allow the members to get training at their own initiative when there is an area where they lack knowledge. In addition to congruent human resource systems, the teams will need team specific feedback. Any performance reports (e.g., performance to schedules and safety records) that previously grouped information by department or trade class will have to be broken down by work team. This will allow the teams to plan as well as evaluate their performance (Hackman, 1990).

Other systems that may need modification in order to support work teams include: planning, engineering, material support, quality practices, communication channels, labor relations, training and development, and selection and promotion. The teams can adopt some of these functions and some of the support departments will need to restructure themselves to support the work teams. An example of support department restructuring for work teams is the support team at the SPX Power Team Division. The SPX Power Team Division in Owatonna, Minnesota, produces hydraulic systems and components, instruments, and maintenance tools and equipment. The support team at SPX was formed to assist the five work teams at the plant. The support team is comprised of the following personnel: inventory planner, production engineer, production programmer, quality

control technician, production supervision, design engineer, buyer, marketing representative, materials specialist, sales representative, and team leader. The support team attends each team's weekly meeting. Members of the support team are individually responsible for providing their assistance and expertise to the team although they actually report to a functional department supervisor. For example, the quality control technician reports to the supervisor of the Quality Control Department.

Supervision/Coachin g The work teams will not be able to assume complete autonomy immediately upon implementation. Therefore, the team must be provided with a leader, a coach. The coach serves two major functions: developing group members and helping the group maintain its boundaries (Cummings, 1977). Some of the assistance that the coach should provide includes:

1) Setting clear guidelines.
2) Assisting the members in acquiring the skills and knowledge necessary to perform their work.
3) Boundary management to enable the team *to* work autonomously.
4) Maximizing commitment and coordination.
5) Recognizing knowledge and skill so the team can weigh individual ideas and contributions fairly. This helps to "build the group's repertory of skill (Hackman, 1990, p.12)."
6) Developing the group's strategies creatively as well as assisting them in avoiding flawed implementation plans when the team is short sighted.

Suzanne Dukes, owner of Hayes Bolt and Supply in San Diego, claims that the coach's role is one of the most instrumental factors of her work team implementation. At Hayes Bolt and Supply, a fastener distributor that employs less than 20 people, the coach facilitates the whole team development and only relinquishes duties and authority when the team is ready. Even though the company is small, Hayes Bolt and Supply found it important to make the transition into work teams slowly so that the team members always feel comfortable when they accept more responsibility. One year after they began the transition to work teams, the coaches, thinking that the teams were ready, delegated more responsibility in a more accelerated pace to the teams. The teams became overwhelmed and uncomfortable and the whole work team structure almost collapsed. At that point, the coaches had to take back some of the responsibilities that were given to the teams. The coaches will assess the situation better in the future and only relinquish duties when the teams feel that they are ready.

After the design team has defined the initial work team design, "all jobs should have the following basic ingredients for empowerment:

- A complete and meaningful piece of work
- Decision-making responsibility
- Opportunities to exercise initiative
- Feedback on performance (Wellins et al., 1991, p.114)"

Work Team Implementation

Prior to the work team implementation, the design team should have two plans:

1) a training plan for the teams, the coaches, and the support departments, and

2) a plan for monitoring and evaluating work team progress.

Work Team Training: When the implementation is deployed, a substantial amount of training will be required. According to Wellins et al., (1991), "most training for teams can be organized into three categories: job skills, team/interactive skills, and quality/action skills (p.164)."

Job Skills: Job skills are the technical knowledge and skills needed to perform the primary task. Such skills and knowledge include welding, operating machinery, quality control, and understanding the company's scheduling process. Extensive job skill training is critical for multi-skilled work teams. A skill matrix can be used by the team to track and develop their skills. A comprehensive skill matrix like the one proposed by Wellins et al., (1991) is included in Appendix 2. This skill matrix tracks proficiency level in addition to skill and knowledge.

Team/Interactive Skills: Team and interactive skills are the interpersonal and communication skills necessary for effective group interaction. Such skills include handling conflict, conducting meetings, negotiating with suppliers and customers, and influencing others.

Quality/Action Skills: Quality and action skills are used to identify problems and take corrective action. The teams can use these skills to reduce cycle times, and make continuous improvements by recognizing customer needs, analyzing causes of problems and creatively generating solutions.

A team must work towards being be well developed in all three of these areas to be successful. For example, possessing the necessary interactive skills does not help a team that is lacking in job skills.

The teams will need some of this training initially well as continual training while they develop. The company should set aside resources for continued education of team members. Wellins et al., (1991) provides an example of one organization's training plan which extends for two years. The training plan is included in Appendix 3. In order to avoid overloading the teams with information, a just-in-time approach to training the teams is suggested. This means that training should be relevant to the activities that the group is performing at any given time. For example, the teams will only require training in interviewing and member selection skills when they need to hire new members. This just-in-time approach to training maximizes retention and the impact on the team.

Coach Training In addition to group members, coaches will require extensive training. Many coaches were formally supervisors and often find it difficult making the transition to work teams. The coaches will have to learn their new roles on the team. Problems often encountered by the coaches include:

1) A need to continue to manage the group the old way.
2) Avoiding taking a stand on sensitive issues because of fear of losing the respect and cooperation of team members.
3) Lack of trust in the team's ability to produce viable solutions.

4) Lack of expertise in coaching and offering assistance without taking responsibility for the team's actions (Wellins et al., 1991).

Therefore, the coaches will need to go through extensive facilitator training in addition to the training that the teams undergo in order to fulfill their new roles. The important areas of training for coaches include: overcoming resistance to change, managing conflict, encouraging initiative, developing member relationships, group facilitation, and performance feedback. In addition, since the coaches will be responsible for some team education, they will need presentation skills training.

Support Department Training According to Wellins et al. (1991), support departments need training since they play a critical role in maintaining empowered teams. Support personnel (engineers, purchasing agents, etc.) have different roles when working with teams. Support departments have to understand the needs of the teams. Similar to the coach's role, support personnel should help the groups with problems without necessarily solving them for the teams. They will need to complete a similar training program that the team members and coaches complete.

The importance of continuous training often goes unrecognized in a work team implementation. Even in companies that commit to substantial training, the team members sometimes feel that it is inadequate. For example, the work teams at the Hewlett Packard Paintjet XL300 plant were given most of their training near the beginning

of their work team implementation. Both the coaches and team members claimed that they did not receive enough training throughout the implementation. The coaches wanted additional education in order to properly guide the teams and the team members wanted supplementary training on tasks that traditionally would have been the supervisors'. The Hewlett Packard Paintjet XL300 division in Rancho Bernardo California is a greenfield site, that is, work teams were used from the inception of the division. At Libby-Owens-Ford, management states that they would invest more in technical team facilitation and leadership training if they had to do it all over again. Both of these companies have fairly mature teams and their implementations were considerably successful. It is clear that a lack of commitment to training can compromise a work team implementation.

Plan for Monitoring Performance: With most work team implementations, productivity decreases initially. Therefore, consideration must be given for other measures of monitoring performance in addition *to* productivity. Some other objective indices that can be used include: personnel turnover, team cohesiveness, quality, rework, and adherence to schedule. This kind of monitoring can be done by using company reports, questionnaires, and observing team interaction.

The design team can now move forward with the implementation and concentrate on managing the change to work teams. Three strategies that can be used to launch a work team implementation are a pilot test, a phased-in conversion, or total immersion.

A pilot study involves implementing a work team with some members of the design team in order to redefine the design as problem areas arise in a work setting. During the study, the environment is controlled for the work team and the group should be given conceptual, experimental and operational protection. Conceptual protection enables the team to design new ways of working. Experimental protection allows the team to redesign and evaluate without the normal demands for productivity. Operational protection involves deploying extra management support until the team becomes fully operational (Herbst, 1956). It is important that the whole organization is aware of the pilot program in order to avoid conflict between employees elsewhere and the pilot work team, which may appear to get preferential treatment. After the pilot work team is fully operational, the design team can evaluate this work structure and recommend improvements in the design before implementing work teams on a permanent basis.

A phased-in conversion involves implementing work teams one at a time until the whole area chosen for work teams is converted. These areas should be able to tolerate initial productivity losses, and have supportive and-empowering managers as well as employees who are interested in empowerment. Once initial areas have improved the work team design and have been successful, then work teams can be applied elsewhere.

Total immersion is the most appropriate strategy for new facilities. This approach changes the whole organizational structure to work teams simultaneously. Total immersion requires the most planning in order to reduce confusion and minimize risk.

Barriers for mdementation: Obviously, work team design and implementation is a complex and difficult task. There are many factors to consider in the plan. Fortunately, so many organizations have tried to implement work teams, that others can learn from their mistakes. The most frequently cited barriers to watch out for include:

1) Calling a group of employees a team, but managing members as individuals.
2) Giving all of the authority to the team at once rather than gradually.
3) Telling the team in general terms what needs to be done and then leaving all the details for the team to work out.
4) Lack of organizational support.
5) Intending to reduce the number of employees with work teams rather than concentrating on improved manufacturing flexibility (Benson, 1992).
6) Assuming members already have the competence they need to work as a team (Hackman, 1990).
7) Using a cookbook approach, that is, recreating a replica of a work team from another organization (Wellins et al., 1991).
8) Insufficient training (Wellins et al., 1990).
9) Managers unwilling to relinquish power to the teams.
10) Impatience about attaining results.
11) Fear and distrust of management.
12) Incompatible organizational systems.
13) First line supervisor resistance.
14) Lack of union support.

ANALYSIS

Prior to implementing work teams in the On-Block Department, NASSCO performed a pilot study of an outfitting work team which called themselves the “Blockbusters.” The following describes the background and results of the pilot study:

The “Blockbusters” Work Team Pilot Study

In the early 1980’s, National Steel & Shipbuilding, Co. (NASSCO) was running out of new construction work and labor-management relations were strained. In an attempt to improve employee relations and morale, as well as benefit from employee ideas, NASSCO began increasing employee involvement in business decisions. The company formed 40 quality circles comprised of about 400 employees. Members of the quality circles included hourly employees from the seven different unions in the shipyard and salaried employees. By 1984, the unions made allowances for some sharing of work between different trades in their labor agreement. This new tolerant labor agreement allowed NASSCO to attempt a feasibility study with a work team in NASSCO’S newly established outfitting area, the On-Block Department.

The experimental work team was called the “Blockbusters”. The block of the ship that was used in the study was the deck house of the second 209,000 DWT commercial tanker that NASSCO was constructing. The Blockbusters work team was formed with members of quality circles and other hand picked volunteers from appropriate trades. A

research paper about the Blockbusters was written by Dan Stravinski, NASSCO'S Human Resources Manager, in 1987. The positive outcomes of the Blockbusters experiment stated in the paper were as follows:

1) Most team members indicated that the work team was a positive experience and more desirable than the typical NASSCO work situation which is trade orientated.

2) Communication, problem identification, and problem-solving skills were improved in the work team environment.

3) The Blockbusters were able to complete the work on the house block with a third fewer man-hours than when the identical block was outfitted on the previous ship using the trade oriented approach.

4) Most of the productivity improvements resulted from better planning and coordination of the different trade activities, as well as improved communication and willingness of team members to help one another.

The Blockbusters paper made the following recommendations:

1) Management/Supervision

Selection and training of management and coaches must foster

empowerment to the work teams. Self-directed work teams need to make their own decisions and enforce their own rules. The coaches' function is to guide and help the teams.

2) Goal Setting/Feedback

The teams need to focus their effortis on a goal in order to improve their performance. They also need feedback so they know how well they are performing and if goals are being met.

3) Stability of Membership

The teams operate more efficiently once the members get to know one another. Rotating members in and out of a work team disrupts the synergy of the group. Due to production fluctuations, work team downsizing and enlarging is necessary. Therefore, careful orientation and training of new members is essential in order to keep the group working as cohesively as possible.

4) Interdependency

Work Teams should only be placed in work environments where there is task interdependency. This means that employees are dependent on one another to complete the job. The purpose of work teams is to increase coordination of complex tasks through increased communication between

employees. Increased employee communication would not add any value to a simple task.

5) Skill Levels

The majority of the members of a work team must be skilled journeymen (not trainees) in order for the team to function independently. Otherwise, a traditional management/supervisor approach is more appropriate.

6) Incentives

A review of the incentive system is in order. Work team members expect incentives for meeting goals that they did not have under the trade approach.

7) Job Security

When employees become cross-trained, they feel as though they become interchangeable and expendable. Supevisors who become coaches feel as though they will be out of a job as soon as the work team is completely self-managed. Management must assure work team members that work force reduction will take place by attrition and coaches can transfer to other areas in the company when they are no longer needed on a work team.

8) Union involvement

Since the unions represent the interests of the tradespeople , they should participate in the transition to work teams. “...if efforts are made to

circumvent labor agreements, union representatives are fully capable of sabotaging any efforts to develop fully involved and committed employees." (Stravinski, 1987)

9) Third Party Involvement

An outside consultant can help the company keep focused when implementing an organizational change. The third party can also make sure that the interests of management, the employees and the unions are represented.

At the time that the Blockbusters were working on the EXXON tanker, NASSCO had no backlog of new construction work. NASSCO'S marketing group was searching for new construction contracts. The only possibility of work in the near future was a contract to build two to four Ammunition Oilers (AOE'S) for the Navy. Of the four major U.S. competitors (Avondale, Bath, Ingalls, and NASSCO), NASSCO was the only one without new construction contracts. NASSCO'S future depended on winning the AOE contract.

Based on the positive Blockbusters pilot study experience, senior management wanted to implement teams department wide in On-Block. The self-directed work team approach was expected to accomplish the following:

1) Flatten the company's structure since work teams are responsible for managing and executing their work.

2) Improve quality.

3) Improve cooperation and coordination between trades/employees.

NASSCO bid on the AOE program under the assumption that On-Block would initiate work teams. NASSCO was awarded the contract and immediately implemented work teams on the first AOE ship. Upper management's strategy was to try using work teams in the On-Block Department for at least two years in order to properly evaluate the approach. The following analyzes the work team design and implementation in On-Block.

Study Methodology

Since the On-Block work teams were disbanded in 1990, interviews in 1991 and 1992 were used to obtain information about the work team implementation. The following people were interviewed:

- The On-Block manager who championed work teams
- The coaches
- Current On-Block management

In addition, 40 team members were surveyed about their experiences on the work teams. Copies of the survey questions are included in Appendix 4.

Socio-Technical Analysis of On-Block

In the mid 1980's, the On-Block department was formed at NASSCO in order to achieve greater efficiency in outfitting ships under construction. A strategy patterned after

Japanese technology was used to accomplish improved efficiency. The strategy involved outfitting large sections of the ship, or blocks, on the ground with piping systems, ventilation, and various metal items such as ladders. On-Block outfitting improved installation rates and working conditions since the blocks could be turned upside down in order to install most of the outfitting items in the down hand position. Then, the blocks were erected on the ship and welded together. All of the outfitting had been previously done on board the ship where many items had to be installed in the overhead position. The following describes the socio-technical system in place at the creation of the On-Block Department as well as the redesign for work teams in 1989.

Technical System Before Work Teams

The primary task in the newly formed On-Block Department was to install as many items as possible on the blocks prior to erection. The key tasks to accomplish the outfitting were as follows:

- Review pre-made plans that identified the material needed to work on the upcoming blocks.
- Plan how to best install the materials on each block and which trade would start first.
- Order the material from the warehouse and in-house shops.
- Receive the material in On-Block.
- Receive the blocks from the Steel Department.
- Ship the material to the respective block location.

- Install pipe, vent, and some metal items on the blocks according to blue prints and NASSCO standards in the down hand position.
- Turn blocks to their erection position and accomplish more outfitting.
- Move the blocks to Sand Blast and then Paint.
- Receive the blocks again to complete post blast and paint outfitting.
- Inspect the blocks.
- Ship the blocks out for erection.

Outfitting the blocks was complex and incorporates many simultaneous and successive interdependent tasks. A simultaneous interdependent task would be two sheetmetal fitters using rigging gear to load and install water tight vent. Neither of the workers could do the task alone since they are dependent on each other. An example of successive interdependent tasks is as follows: a layout person marks the location where a run of pipe should be installed on a block. A pipefitter then fits the pipe in the location indicated by the layout person and tack welds the hangers in place. Finally, a welder completely welds the pipe fittings and hangers. Many variances had to be controlled in order to successfully complete the numerous interdependent tasks in On-Block. The key variances that would disrupt completing the major tasks included:

- Late or missing material (vendor and internally supplied).
- Components (pipe, vent duct, etc.) not fabricated correctly.
- Receiving the wrong or damaged material.
- Material shipped to the wrong block location.

- Internal suppliers late, that is, blocks shipped late out of Assembly, Sand Blast, or Paint, or components fabricated behind schedule in the shops (Pipe, Sheetmetal or Plate Shops).
- Blueprints issued late.
- Blueprint errors such as interferences, wrong material specified, design not according to standards, etc.
- Engineering change notices (ECN'S).
- Incomplete or unstructured planning.
- Trades that installed supports and braces in each other's way.
- Standards not adhered to.
- Inexperienced tradespeople (trainees).
- Block set in the wrong position by the cranes for outfitting

Social System Before Work Teams

The roles of On-Block personnel as well as support personnel were as follows:

- The On-Block foremen, in conjunction with the trade planners, reviewed the blueprints and prepared plans for accomplishing the work.
- The material chasers in On-Block ordered the material and shipped it to the block location at each foreman's request.
- The foremen gave work assignments to the tradespeople.
- The tradespeople communicated all problems and needs to their foremen who then took care of the situation. For example, if a pipefitter needed a

welder to weld some pipe hangers in order to complete a workpackage, the pipefitter would tell his/her foreman. Then, the pipe foreman would request welding service from the welding foreman.

- The trade skills used to accomplish the outfitting were pipefitting, shipfitting, sheetmetal fitting, and welding. The department was separated into these product categories. Each foremen was responsible for one product category.
- The foremen from different product categories informally coordinated their work on the blocks with each other.
- The Quality Assurance Department inspected the blocks for defects prior to erection.
- The block movement coordinator scheduled all block moves (Assembly → On-Block → Sand Blast → Paint → On-Block → On-Board) and turns. The block movement coordinator regularly interfaced with the On-Block foremen and the following departments: Crane and Rigging, Steel, Sandblast and Paint as well as other support departments.
- Engineering liaisons were accessible to On-Block personnel in order to help solve technical problems as they arose.
- Trade superintendents were accountable for their own trade's performance.
- The On-Block manager was responsible for the blocks moving according to schedule and coordinating trade meetings.
- The Human Resource Department and trade superintendents handled all

personnel functions such as hiring, compensation, attendance and trades training.

The social system was made up of specialists and did not give the tradespeople the opportunity to interface with many people even though the technical system required a high degree of coordination. On-Block intended to adopt a larger percentage of the outfitting on future contracts and it was apparent that the social system was insufficient to improve coordination with additional work. The logical decision was to redesign the socio-technical system. The new work structure that On-Block chose was self-regulating work teams.

Work Team Socio-Technical System

On-Block management used information from the Blockbusters pilot study in order to design the teams. In On-Block's redesign of the work structure, most of the changes were made to the social system rather than the technical system. The following were the changes to the socio-technical system in On-Block's work team design:

- The Production Outfitting Planning Department (POPS) was formed to identify material for the teams to install.
- The coaches and On-Block detail planners planned the work within the parameters of the master schedule.
- Tradespeople communicated directly with each other instead of going through the foremen when they needed assistance. For example, a

pipefitter would ask for welding support directly from a pipe welder rather than requesting through a supervisor.

- The teams requested their own material for upcoming blocks from the material group in On-Block.
- The On-Block material group ordered material from the warehouse and in-house shops.
- The teams and coaches planned day-to-day activities and assigned daily duties.
- In the beginning, the teams were made up of multi trades with approximately the following composition: 4 pipefitters/outside machinists, 2 pipe welders, 1 electrician, 1 sheetmetal fitter, and 2 shipfitters. Later, material chasers, and helpers were added to the teams.
- The teams were responsible for outfitting the blocks, updating the work progress they had made, completing transfers of work, visual quality inspections, obtaining Quality Assurance inspections for contract specific requirements and when certification was needed (X-ray joints, NDT inspections, hydrostatic tests, etc.).
- Tradespeople were to be cross trained on the job so they would have interchangeable skills.
- The coaches (previously foremen or tradespeople) were responsible for assisting the team in implementing successful plans for outfitting the blocks. The coaches were responsible for the productivity of their teams.

- The team leaders were to run the team meetings and represent the team in meetings with management and other departments. The team leaders received working foremen's pay. The team could replace a leader at any time.
- Two lane managers were responsible for the teams in their lanes.
- The On-Block manager was accountable for the collective performance of the teams.
- The following human resource functions were modified:
    1) The teams evaluated the leaders and coaches and participated in self-evaluation. However, these evaluations did not affect compensation.
    2) The team leaders were given premium pay which was not part of the union-management contract.
    3) Attendance was handled jointly by On-Block management and the teams. If the On-Block manager received a phone call from the absent team member, then the manager would write a memo to the labor relations department to waive the penalty the team member would have normally received. The teams decided on disciplinary action for members with excessive absences.

The following responsibilities remained the same:

- The block movement coordinator scheduled all block moves and turns.

- Engineering liaisons assisted the department.
- Quality Assurance performed inspections that the teams were not qualified to do.
- Hiring, firing and compensation were handled by a centralized human resources department.

During On-Block's work team planning stage, a partially effective socio-technical analysis was performed on the previous work structure. The primary task of outfitting an entire block was identified as being a whole piece of work and the many sub-tasks of the tradespeople were correctly identified as being interdependent. These are indeed the conditions that are conducive to work teams. On-Block managers also identified key variances that must be controlled before work teams could develop, such as adequate planning and work package construction, improved material control, and adequate team skill levels to allow them to function independently. The company was effective at identifying these key variances, but less successful at controlling them. The basic work team structure was sound, yet some factors were not regulated as well as others in order to optimize the socio-technical system.

On-Block's Work Team Planning and Implementation

In January 1989, NASSCO converted the whole On-Block department to self-regulated work teams using the above design. This conversion was scheduled to start on the AOE-6, the first ship of a multi-ship contract for the Navy. The following discusses NASSCO'S implementation of work teams.

On-Block management had 6 months to implement work teams before outfitting was scheduled to start on the AOE-6. This short time frame imposed an accelerated planning stage for work teams. No one at NASSCO had ever been involved with work teams other than the Blockbusters pilot. Therefore, On-Block Management had to quickly do some research in order to devise an implementation strategy.

On-Block Management planned for the change for two months after they were given the directive to implement work teams. They began to hire support personnel (office staff, material chasers, planners, etc.) to help make the change. Some of the personnel that were going to be coaches worked with Production Outfitting Planning to identify the work for On-Block on the first ship. On-Block management also looked for team members. Team members were hand selected from other departments based on their skill level. They were transferred to On-Block for training just three weeks prior to the start of work in the department. The following discusses those three weeks of training:

During the first day in On-Block, the teams were shown the film on the Blockbusters work team and a Tom Peters film, *The Leadership Alliance.* The intent of showing these films was to illustrate the direction that the manager of On-Block was attempting with the department. During the next two days in On-Block, the tradespeople attended an orientation which provided the team members with an overview of the various support departments at NASSCO. Presentations were given by managers of the support departments in the following areas: safety, quality, production schedules, production

outfitting planning, labor budgets and NASSCO'S Labor Management System, personnel services, security, production services, palletization of work, packaging material, transferring work, the material systems, general warehousing and receiving, mainframe information systems, engineering drawing and ECN distribution, and contract adherence. At the end of the first week, team members received rigging and T-1 tack welding training. The rest of the cross training was to be attained on the job. In addition, the coaches and lane managers were given training on accessing information in the mainframe computer, reviewing workpackage content, and updating workpackage information in the mainframe.

During the second week, the coaches and team members received separate training on team building. These sessions were given by outside consultants and included the following topics: history of the project, problem solving, self assessment, personality effects on teamwork, communication, functions of a team, skill levels and personality types, rewards and incentives, establishing performance standards, evaluating procedures, and resolving issues. On the last day of this second week of training, the team members went through an exercise where they identified problem areas and brainstormed on resolutions to those problems. Then, they met with senior management to voice concerns in the following areas: management's commitment to work teams, availability of material to support outfitting, and the number of vendors being used to fabricate parts for the contract. Senior management addressed the anxieties of the group and assured them that management was concerned about NASSCO'S competitive posture and had worked diligently to get the company where it was in the work team evolution.

During the third and last week of training, the teams received an orientation of the On-Block Department. This orientation included reviewing drawings and material for the start of outfitting the following week. In addition, safety was highly stressed. Team members were given instruction on how to work safely.

Members volunteered to be leaders during one of the team building sessions. During this session, the leaders picked their own team members. Team size and trade mix were determined by On-Block management prior to selection.

After the three weeks of orientation and team building, the work teams were given their first blocks to outfit. Almost immediately, they ran into key variances that disrupted their work and prevented them from completing the work assigned to each block. The problems that the teams had were not due to the teams themselves, but were caused by an ineffective design and implementation plan. The following analyzes this plan:

Vision

The company had a clear vision. However, the coaches stated that they did not feel that it was effectively communicated. As a result, the teams felt as though they did not have a clear vision.

Boundary Management

This function should have provided the team with influence over transactions in their task environment by protecting the work system from external disruptions and regulating exchanges with the environment. This function was not established prior to work team

implementation. It was not clear who should be performing the boundary management function. It was mainly left up to the coaches and the teams. The work teams were faced with such external disruptions as routinely late materials, excessive ECN'S, and changes to the standards.

In addition, the regulation of environmental exchanges was not effective. For example, there were few inspections for outfitting materials such as pipe or vent spools supplied to On-Block. As a result, material discrepancies were not found until the teams tried installing the items. Also, problems with the workpackages were encountered in the field. The workpackages were not tailored to meet the skill levels of the team members and the work scopes were often changed after the workpackages were issued. Since these exchanges were not well controlled at the task boundary, the teams were constantly managing the problems that follow these kinds of disruptions instead of concentrating on the primary task. Unfortunately, the coaches and the teams had little authority to control these disruptive environmental influences.

Task Control

Task control provides the team with the regulatory power to control their work process. Although the teams were given immediate autonomy, they could not control the work process since they had to concentrate mainly on solving the problems that occurred in their environment. The team members were not used to interfacing with personnel from other departments, nor solving the policy problems that they encountered. The teams

were prepared to plan their work, set work methods and eventually look for more efficient methods. Unfortunately, they were so busy managing problems and learning about the organization, that they could not concentrate on improving the work process.

Team Composition

Team composition is a very important factor to which On-Block management devoted considerable attention. However, there were difficulties with trade mix, team size, and skill level of new members (journeymen and trainees). The efficiency of the teams was affected by the trade mix of the teams. The initial trade mix of the teams was determined by optimizing the projected mix needed in the middle of contract on the first ship. However, some trades, such as the electricians and sheetmetal fitters, were not needed on the blocks scheduled for On-Block early in the contract. These tradespeople were not effectively cross-trained, so their ability to assist other trades was minimal. Since they were not as busy as the other tradespeople, some resentment formed affecting efficiency and morale. This could have been an ideal opportunity to cross-train the trades that were not busy. The productivity of the teams was also reduced when the teams were given additional members several months into the contract. This caused three problems for the teams. First of all, each team increased in size to about twenty five members which was too large to manage. Secondly, the new members were mostly trainees who did not have the trade expertise to add as much value to the team as the original members. Finally, these new members did not understand the work team process since they were not given an orientation when they transferred to On-Block. Therefore, the new members needed

substantial assistance from the original team members. The work team plan should have made provisions for adding new members when production increased in order to avoid disrupting the work flow of the teams.

Organizational Supports

Since work teams were implemented in only one department, most support departments were neither equipped nor trained to assist the teams. The biggest obstacles that the teams experienced were caused mainly by inadequate support from Materials and Engineering.

Materials: Many of the materials that the teams needed were late or missing. Vendor support was poor and the shops did not know the correct sequence for manufacturing components in order to support the teams.

Engineering: Engineering problems consisted of late drawings, blueprint errors and ECN'S originating from internal and external sources. In addition, inaccurate specifications were often given to the vendors which resulted in incorrect vendor supplied material. The teams found many interferences on the blueprints as they were working on the blocks. The teams would have to wait for an ECN to be issued or expedite the process by suggesting a redesign to the engineering liaison who would then get the official ECN issued. Not only did the teams have to process a lot of ECN'S that affected their assigned work, but they also had to handle ECN'S that affected shop made material that they had already received in

On-Block. Many of the engineering problems were inherent to NASSCO'S strategy change from accomplishing all of the outfitting on board the ship to outfitting blocks. When NASSCO did the outfitting on board the ship, Engineering had more time to complete their outfitting drawings. With the new strategy, the outfitting process started earlier in the contract. This also meant that outfitting material had to be ordered closer to the beginning of the contract. However, Engineering did not start their work any earlier in the contract than they did when NASSCO outfitted on board the ship.

Like Materials and Engineering, many other departments were not providing the necessary support to the teams. Inadequate support was also due to lack of expertise in the yard at the time. NASSCO had just recovered from a large layoff. Many of the people who were hired into support departments during the growth did not have experience in the shipyard. inadequate support for the teams was not a function of other departments not wanting to help the teams but more of a function of experience and lack of training about work teams. Figure 1. contains a page from a coach's log book. This passage exemplifies the support problems that confronted the teams.

Figure 1. Excerpt from a Work Team Log Book

October 9, 1989

- Did not work block because pipe #111 will hit pipe #3. Waiting for answer from Engineering.
- All bolts are temporary. Waiting for ECN
- One 3-way and 6“ check valve are too short and would not align with the pipe.
- Asked for layout service on ladder installation. It took the Layout Department 3 hours to answer.
- Vent running into pipe. Waiting for an answer from Engineering.
- Still need second deck to be heat shrunk. It should have been done last Saturday.
- The print for pipe spool #59 calls for offset and spool sheet calls for straight pipe. Waiting for an answer from Engineering.
- Pipe spool #65 was damaged by a forklift. Had to fix it.

Remarkably, this is only a portion of the excerpt which covers only one day’s work on one block!

According to the coaches, the teams were not equipped to solve these kinds of organizational support problems. They needed established policies and procedures and restructured support organizations that could provide adequate service for the On-Block Department. Quality Assurance was one department that involved themselves in the work team design and assigned an inspector to support On-Block even though he still reported to the manager of Quality Assurance. Still, most departments continued to operate as before. For example, NASSCO'S centralized reporting and information department made no changes to their service for On-Block. As a result, schedule and budget performance data sorted by work team was not available. On-Block planners had to order reports sorted by work package and generate reports for the work teams on personal computers. In addition, only a few human resource policies/systems were modified to suit the teams. The attendance system was changed for the teams, but the teams had to manage with existing company wide compensation and hiring policies.

Supervision

Supervision is a key factor to successful work team implementation since it is supervision's role to guide team members through the transition. Unfortunately, there was a lack of focus on the design of the coach's role. The coaches felt that their roles were ambiguous and confusing. Authority and accountability were undefined for the coaches. The teams were told that they would make decisions by consensus and that they were responsible for their performance. However, management held the lane managers and coaches accountable for the decisions made by the teams as well as team performance.

Training Plan

A comprehensive and continual training plan should have been a part of the work team design. All of the major players lacked adequate training in order to make a smooth transition to work teams. None of the coaches thought that training 'was sufficient for them or the teams.

Training for the Teams: The coaches felt that the teams did not have enough training in all areas (job, team/interactive, and quality/action skills). All of the coaches surveyed claimed that the tradespeople should have had more practical information about work teams. There should also have been extensive cross training in order for the team members to make the transition into the work team structure and perform work outside of their own trade. Cross training was not accomplished to the extent that was originally intended. No formal plan for cross training was established and no time was allotted for training. Journeymen were expected to cross train one another on the job without extrinsic incentives (more pay, bonuses, etc.) or training experience. The coaches could not perform the training function either because they were usually experts in only one trade and they also lacked teaching experience. In addition, any skill level attained through cross training was easily lost since members were not often given the opportunity to use their new skills. Once the teams were in full production, the teams would tend to assign work to members only in their own trade since they were accountable for efficiency. Team members were only assigned work outside of their trade when there was no available work for them within their trade. Since most of the training consisted

of team building and group interaction theory, the teams were lacking in job (cross trade) and quality/action skills. In addition, training should have been gradual and continuous. Instead, all formal training was accomplished within the first three weeks. The coaches said that the training was overwhelming since it was done all at once.

Training for Coaches: The coaches had the same training as the team members. They also felt as though their training was inadequate. Coaches were supposed to provide the teams with expertise in the areas of job skills and implementation and yet the coaches received no training to prepare them for this role. They lacked the confidence to assist tradespeople outside of their own trade as well as the direction necessary to mold a group of tradespeople into an effective work team.

Training for Support Departments: Virtually no training was accomplished for support departments. This partially explains the limited support that the teams received from other departments. Many departments at NASSCO did not understand the work teams nor their needs. In addition, due to the start-up of a new contract, many people in the support departments were new employees still learning their functions. Support departments were willing to help, but without training, their support for the teams was limited.

Plan for Monitoring Performance

Since productivity decreases initially with work team implementation, other measures

should be used to judge performance such as team cohesiveness, quality, rework, etc. For the most part, the teams were evaluated and received feedback on their progress outfitting the blocks. Their productivity had hardly increased by the 18th month. Productivity losses could not be tolerated, so the teams were disbanded. Ideally, NASSCO should have implemented work teams during a time when productivity decreases could have been tolerated in the short term or controlled by a more gradual approach. Then, the teams could have been evaluated through other indices in order to properly judge their progress.

Human Resources

Even though the teams ran into many technical problems, the members obtained many benefits from belonging to a team. The surveys of the work team members showed positive results in human resource areas. The results of the surveys are included in Appendix 5 and 6. Of the forty team members surveyed, 25 were part of the core group and 15 members joined the teams a few months after the teams started. There were virtually no differences in the responses between these two groups. In addition, age and trade class appeared to have no affect on responses.

The team members and coaches indicated that improvements were made to job enrichment and the impact of absenteeism and personal problems with the work team approach. Ninety eight percent of the team members surveyed felt that they could influence how work would be done and 85% learned problem solving skills as members

of work teams. They also felt as though they were given opportiunities to use more skills on the job. Ninety three percent of the respondents indicated that the work teams provided a positive experience. Seventy three percent of the respondents also claimed that the work teams improved their personal workmanship and performance, and 75% of the members felt individual performance improved as a result of peer pressure. The coaches felt that absenteeism and personal problems affected the work process less with the work team structure. Even though the absentee rate did not change with work teams, members would notify the team when they would be absent. This helped the team to plan their work accordingly. Prior to work team implementation, tradespeople did not notify their supervisors of planned days off, instead, they would just not show up for work. In addition, personal problems that affected work quality surfaced earlier since members supported one another.

Still, the teams were not able to attain high productivity due to problems with the design and implementation. Their blocks averaged only about a 60% completion rate of the planned work when they left the On-Block area. This meant that a large portion of On-Block's work was transferred to the On-Board Department. The On-Board Department, which is located on the ship, is responsible for completing any outfitting that is not accomplished in On-Block. On-Board has a considerable disadvantage, outfitting in confined spaces and in the overhead position. This is why On-Block's goal is to complete all of their work and avoid transferring work to On-Board. Therefore, just 18 months after the implementation of work teams, the manager of On-Block was replaced and the new manager, after extensive review, disbanded the teams.

Implementation Strategy

NASSCO'S implementation followed a pilot test approach. The Blockbusters were the pilot work team. Since favorable results were obtained with the Blockbusters test, NASSCO decided to implement a total immersion of work teams in the On-Block Department. NASSCO intended to build upon the information that they learned from the Blockbusters pilot test. The full implementation in On-Block only utilized some of the lessons learned in the pilot test. The following recommendations made by the Blockbusters paper were successfully employed:

1) Effective selection of supervision/coaches. Based on the interview feedback, the coaches selected were appropriate for the job. As a result of careful coach selection, there were few reported problems with coaches who continued to supervise and give orders rather than let the teams make decisions. For the most part, the coaches who were mostly foremen, already knew how the primary task was to be accomplished.

2) Work teams should be implemented in areas with interdependence. The On-Block area was a logical choice since the different trades are dependent on one another to complete each block. More coordination between trades was the result.

The following recommendations made by the Blockbusters paper were not considered thoroughly:

1) Proper training of the supervision/coaches. The coaches that were interviewed did not have a clear understanding of their roles as coach. They would have liked some training in this area as well as in those trades that they lacked knowledge.

2) Team size variations due to fluctuations in production mandate extensive training and orientation for new members. In practice, new members did not receive any formal training and orientation. This disrupted group cohesiveness since new members did not know how to work in the new team environment.

In addition, the plan for total work team immersion did not consider that the success of the Blockbusters pilot may have been in part due to the assumptions and control of key factors as follows:

- The blocks that the Blockbusters outfitted were not as complex as the AOE blocks that the work teams would have to outfit.
- me contract that the Blockbusters worked was commercial and had less customer changes and less complex standards for the coaches and tradespeople to understand.
- Boundary control was guaranteed for the Blockbusters since the project was under management's watchful eye. For example, the Blockbusters had all of their

materials readily available as well as full cooperation of support personnel.

- The Blockbusters team was made up of an elite group of volunteers with excellent trade skills and self-motivation. Today, most of the Blockbusters team members have worked their way into planning and supervisory roles.

In short, the Blockbusters were given the tools necessary to perform their work in the most ideal manner. The same opportunity was not afforded to the On-Block work teams since they operated in a more complex environment which was not controlled.

Even though the work teams were disbanded, the implementation was not a total failure. NASSCO did profit from the work team experience. Some of On-Block's foremen who were coaches still ask for input from their crews. The foremen have learned from the coach role that communication is important for coordination as well as employee morale. The tradespeople are still somewhat involved in choosing work methods rather than merely taking orders. Another benefit of the work team experience to NASSCO is the faith that the tradespeople have that management is continuously trying new methods to keep the shipyard competitive.

RECOMMENDATIONS

Work teams can still be a viable work structure at NASSCO. However, implementation in a less complex area such as the pipe shop or sheetmetal shop could prove to be a better starting point. Eventually, work teams could be expanded into On-Block again. The following describes some options and recommendations for re-implementing work teams in On-Block.

NASSCO'S experience indicates that several factors must be considered well in advance of such a large work structure change. These factors include heavy commitment and involvement from senior management, union involvement, and a design which considers flexibility, team composition, technical expertise, boundary control, simplification, extensive training, and compatible feedback and human resource systems.

Senior Management Commitment

Management must take an active role in the work team design and implementation. This includes thoroughly researching work teams and understanding them, devising a sound implementation strategy, and planning and committing to substantial and continual training. Senior management should be very knowledgeable about work teams if they are to be the way the company does business in the future. Knowledge about work teams can be gained by participating in site visits to companies that have work teams as well as reading literature and attending seminars on work teams. Then, senior management

should devise a vision for the company which includes work teams as a strategy to achieve company goals. Also, since work team implementation is a major organizational change it should not be left to one person. Therefore, senior management should assume a steering committee role and select a design team to perform in depth research, design and guide the implementation of work teams. A design team comprised of future coaches and team members, On-Block management and support personnel can ensure that all of the areas of concern are covered in the design and implementation plan.

Union involvement

Since one goal of the unions is to keep their members gainfully employed, efforts must be taken to assure the union leadership that the purpose of work teams is not to eliminate people, but to make the organization flexible and competitive. Negotiations with the unions should be focused on achieving the most competitive work structure possible. This should be done prior to design and implementation planning so that the work team design conforms to the labor agreement. Like NASSCO'S implementation, the union must always feel as though it is *a* contributing member in the work team implementation.

Flexibility

The structure of the work teams should allow them flexibility to get the work done during environmental fluctuations such as engineering changes, or late material. This is where NASSCO must carefully choose the best work team structure that will provide the teams with flexibility as well as satisfy organizational and union constraints. The following lists three possible structures:

1) Cross-Functional Work Teams

A cross-functional team structure means that all members of the teams would maintain a specialized function. Team members would work only within the abilities and boundaries of their own trade classification. The team would provide the tradespeople with a means for improving their communication and coordination. This design is the most appropriate when the union leadership and management have agreed to no cross trade work, or it is not feasible for team members to learn each other's jobs. A cross-functional approach provides the least amount of flexibility for the teams to accomplish their work since members can not perform all functions. As a result, a cross-functional work team in a shipyard outfitting area can have problems with team composition. The same trade mix is not always required to outfit each block or the same block at different times. Therefore, work is not always available for everyone. For example, some trades will have minimal work left on the block after paint and others, such as electrical, will have substantial work left. In addition, team cohesiveness could be compromised since the team members will not necessarily understand the needs and concerns of the other trades. Still, the department and tradespeople can benefit from forming cross functional work teams. The work team structure can improve the communication and coordination between the various trades.

2) Cross-Trained Work Teams

A cross-trained work team would involve redefining the trade classifications to allow for multi-skilled team members. This approach is appropriate for a nonunion yard or a yard

where the union has agreed to complete cross training. Cross-training of team members gives the teams the largest amount of flexibility of any structure to complete the work. Also, when each team member can perform or understand all of the jobs on the team, the team tends to have increased communication and cohesiveness. On the other hand, a complete cross-trade approach requires a comprehensive training plan which would involve an extensive amount of time and money. in addition, the team members must be capable of mastering more than one trade. Due to the many specialized skills required in outfitting, this structure would be difficult to implement. However, this approach could be implemented elsewhere in a shipyard, like the pipe or sheetmetal shops, where all team members would have the ability to master all of the jobs, due to the decreased variety of tasks.

3) Cross-Functional Work Teams With Some Cross Training

A compromise of the two structures above is another option for a work team design. A balance of cross training can be achieved that will allow some flexibility for the teams during environmental fluctuations. This approach could appeal to some unions who are working with management to improve productivity, but desire to preserve the various trade classifications. The team members can be trained to perform the more easily learned and frequently used tasks in outfitting. These kinds of tasks include layout, rigging, tack welding, burning, and silver brazing. The majority of these skills are currently used by different trades at NASSCO. Even though the team members would not be trained in every job, they would have a better understanding of each trade through the

cross training that they received. For example, a pipefitter who can tack weld and silver braze would have a better understanding of the amount of time that it would take a welder to weld a pipe joint. This approach would have less problems evenly distributing the work load among team members as with the cross-functional work team structure. Because training will be continuous, slack periods for individual trades can be opportunities for cross-training.

Since some cross-trade work is allowed by the seven unions at NASSCO, the third work team structure is the best choice for On-Block. Cross-functional work teams with some cross-trade work can provide flexibility to the teams as well as the opportunity for team cohesiveness.

Work Team Composition

Special attention must be paid to trade mix, especially with cross-functional work teams. Otherwise, the same problems that NASSCO had utilizing all team members can occur. Bath Iron Works (BIW), a shipyard in Bath, Maine has recently implemented cross-functional work teams in their pre-erection outfitting areas on a pilot basis. Since their union would allow incidental work, but no cross training, BIW had to resolve team composition problems with their cross-functional teams. Since each work team at BIW completes one block at a time, many of the work team members are not needed after the block has been painted due to lack of work for their trade. Therefore, these additional team members are transferred elsewhere in the company until their work team begins

another block. Another solution to this team composition problem would involve careful scheduling and planning in conjunction with the work team design in order to maximize the utilization of the team members. The intent is for the work team structure to suit the work scheduled for teams. If each work team worked on like blocks then the team composition would correspond to the work required on those blocks. For example, one team would mainly work on inner bottom blocks while another team worked on wing tanks. Then, each work team would not necessarily have the same trade composition. The work team trade mix would maximize the utilization of its members and be tailored to the type of blocks that each team outfits.

This last approach resembles a plan that On-Block has for the next contract awarded. This involves reorganizing the department into physical work stations. Each work station would outfit like blocks and maintain the same personnel. The intent is to achieve a quicker learning curve on similar blocks than previously attained. This approach would make the transition to work teams less dramatic. The work station approach would also help to solve the team composition problem by keeping a steady work flow for all trades on each team.

Boundary Control

Boundary control roles must be defined up front. The function of boundary control is to protect the work system from external disruptions, and to regulate exchanges (inputs and outputs) with the environment. Then, the work team can keep a steady pace. It is

imperative that the work teams receive accurate drawings, the correctly kitted material on time and manageable workpackages. A company wide system for quality control can help to keep disruptions out of the work teams' work process. For example, Engineering should perform quality checks on their blueprints and bills of material, and the Warehouse should inspect all received material for conformance to specifications. This will allow the departments the chance to correct any discrepancies before they enter the teams' work system causing excessive rework and hardship. The work team members and coaches can participate in some of the boundary control roles. For example, coaches and/or delegates from the teams can review workpackages with the production planners in order to ensure that the packages are manageable and accurate. Coaches and work team members can also track the quality of the inputs that they receive in order to provide feedback to suppliers on quality and reduce the number of disruptions for the teams.

Another way of improving boundary control would involve reorganizing the technical support departments so they are compatible with work teams. Then a team of support personnel would perform some of the boundary control roles for the work teams. For example, although a purchasing agent would still report to the purchasing department, he/she would be accountable for supporting one or all of the work teams. The purchasing agent would be a point of contact for his/her team and expedite material arrival. The purchasing agent would be a team member and attend team meetings. Other support personnel that should be assigned to the teams include planner scheduler, design engineer, accuracy quality inspector, material support technician, and standards

engineer. By being members of the work teams, the support personnel would feel more involved with production and see the value of their contributions. The work teams, in return, would have more of an influence on their environment.

On-Block should require the establishment of the above boundary control functions before implementing work teams. If On-Block's suppliers cannot guarantee that they can meet their schedule, ensure quality products, and resolve discrepancies in a timely manner, then On-Block should not proceed with work teams. As seen in NASSCO'S previous work team attempt, work teams are not the solution to organizational problems. Stability needs to be achieved before the work team implementation.

Technical Expertise

Technical expertise is another issue that must be resolved. Due to the highly specialized skills required in outifitting, and the problems that can occur, the teams will need technical experts. The design team must decide who will fulfill this function. The following illustrates three feasible options:

1) The Coach as the Technical Expert

Each coach could be the sole technical advisor for his/her team. This option would be difficult to achieve in the outfitting area due to the diversity of the trades. For example, it is unlikely that a coach with a great deal of experience in piping could also become a technical expert in sheetmetal, welding, electrical and shipfitting. However, a coach of a

work team could be the technical expert if the team works in a less diverse area such as the pipe op. If the coaches are expected to be the technical advisors on all jobs, extensive training for them is imperative.

2) A Technical Advisory Team Comprised of all Coaches

If each coach happens to be an expert in one of the trades, the coaches, as a group, can provide the expertise for all of the teams. This would be the case if the foreman from each trade became a coach. The coaches could be available as a group, or individually, to help any of the teams with trade specific problems. This approach could have some problems if the level of competition between teams was high. Then, the teams might pressure their own coaches to avoid helping other teams. In addition, if the coaches' are given too many duties, they will not have enough time to devote to their team's development.

3) A Technical Advisory Team Comprised of Trainers

If the coaches' roles and backgrounds will be less technical, the trades training personnel can be the technical advisors for the teams in their field of expertise. The trainers would already be perceived as experts by the tradespeople who have gone through trade training. However, the trades trainers may not feel accountable for providing the teams with technical support since their main function is training. Therefore, the trainers/advisors should take a participative role in the work team development. This means that they would be highly involved in the work team implementation and also held

accountable for the level of trade mastery of all of the teams as well as the quality of workmanship.

The need for technical advisors would be reduced if NASSCO could ensure good boundary control for the teams and the skill level of the team members was high. Then, the coaches, who would have trade foremen experience, could be the technical advisors in their own area of expertise. The coaches could answer individual questions as well as meet together weekly to discuss common problems. If the coaches as a group cannot resolve a technical problem, there are other experts at NASSCO available for consultation such as the engineering liaisons, quality assurance inspectors, trade trainers, and On-Block management.

Simplification

NASSCO was operating in a complex environment when they implemented work teams. This made the transition difficult. Any future attempts at work teams should be made in the simplest environment possible. A feasible plan would be long term, and involve implementing work teams on a three or more ship contract in the commercial market. The department could completely restructure to work teams by the third ship when the environmental disruptions (engineering and material problems, etc.) for the teams would be low. In addition, the ship design should incorporate a simplified manufacturing process. This would be achieved by concurrent engineering at the design stage considering the simplest ways to achieve the highest levels of outfitting. Also,

uncomplicated standards that can be easily understood by the tradespeople should be used. This would reduce confusion and make cross trade work easier. In addition, simplification reduces the required flexibility and boundary management efforts.

Training

Training is the area where NASSCO will probably need the most resources. Without a strong commitment to continual training, work teams should not be implemented. Once there is a commitment, the Just-In-Time (JIT) training plan as suggested by Wellins et al. (1991), should be considered. With the JIT approach, coaches, team members, and support personnel receive training just prior to when they need to utilize the skills/knowledge. This maximizes retention and spreads out the training over time which will minimize confusing people with massive amounts of concentrated training.

Trainers

Different people will provide training for the teams since training is needed in many areas. Some of the trainers will be in-house expertls and others will be brought in from outside the company. It is important to make sure that all trainers are qualified to teach since a technical expert is not necessarily a good trainer. The following describes the types of personnel that may provide training in the three basic skill areas:

Job Skills: NASSCO currently has extensive trades training programs. Therefore, the job skills training would probably be done by the trades trainers.

Team) interaction Skills: Most likely, an outside *source* would be used for this type of training. Eventually, in-house experts can be cultivated and the company can do its own training. In addition, the coaches can perform some of this training in the field. A formal training program should be established by either the Human Resources Department or the On-Block staff. This program should include an orientation for all new team members as well as continual training in team/interaction skills.

Qualitv/Action Skills: For some of these skills, such as quality inspections, the Accuracy Control Department can provide an expert trainer. For other skills, such as cycle time efficiency there may not be an in-house expert. In this case, an outside trainer can be brought in to train the teams and coaches and/or an in-house trainer.

Team Member Training

The areas of training needed for the teams consist of job, team/interactive, and quality/action. Experienced journeymen at NASSCO already have their basic job skills. However, if cross training is required of work team members, then everyone will need more job skills training. This can be done prior to work team implementation if the tradespeople will be using their new skills. For example, if the company decides to start work teams on the third ship of a class, then they can start the job skills training on the first two ships and require tradespeople to use these skills regularly. Then, when work teams are implemented, the tradespeople will be proficiently cross-trained and the company can concentrate on the other areas of training. Obviously, job skills training will

still be on going due to quality concerns, changes in work methods, etc. In the training plan, the level of cross trade skills required to be an effective team member should be clearly defined. Then, team members should be encouraged to continue cross training in other skills for personal advancement. Some team/interactive skills will be necessary just before the teams are formed. The teams will need to learn how to conduct meetings efficiently, how to work in a team, and how to handle conflict within the team. As the teams get more involved in the business aspects of the department, they will need training in areas such as presentation and negotiation skills and how to handle conflict with other departments. Quality/action skills training should be reserved until the teams feel that they have a handle on their new work structure and the work is flowing well. Then, the teams can learn how to analyze their work systems in order to make improvements. This type of training includes implementing process control and reducing cycle times.

Coach Training

Since the coaches have one of the most instrumental roles in work team implementation, they must be given extensive training as well. Most importantly, the coaches need to know what the company is trying to achieve. The coaches need education on the company vision and how work teams can help them to attain company goals. In addition, the coaches should have training on team facilitation and teaching skills. This will enable the coaches to guide their teams and determine when they are ready for more training as well as additional challenges. Like the work team members, the coaches will need training on team/interactive and quality/action skills. If the coaches are taught these skills first, they can help reinforce their team's formal training in the field.

Training for Support Personnel

Support personnel in On-Block, as well as personnel in other NASSCO departments, need to understand what the company is trying to achieve with the work teams. These personnel should have their own training program on work team principles. Work team members should participate in training these personnel in order to communicate the work teams' needs. In addition, other departments need to know who to contact in On-Block on various issues, and who is responsible for areas such as quality, receiving material, and updating work progress. Training of other departments will reduce confusion in the company and ensure that the work teams receive adequate support.

Feedback System

The teams and the company need to continually assess work team performance. Initially, and each time the teams take on more responsibilities, productivity may decrease. Since these productivity dips are expected before performance can be improved, the work teams should be evaluated on other indices as well. For example, quality of workmanship, personnel turnover, and team cohesiveness can also measure how well the team is progressing. The teams will initially require the coaches and support personnel to provide this constructive feedback on their performance. Eventually, the teams can set up their own performance measurement systems to monitor themselves.

Human Resources Issues

If the company is determined to implement work teams in On-Block and/or in other areas

of the yard, then an extensive review of the human resource systems is in order. NASSCO'S hiring, compensation, educational, and attendance systems would have to be conducive to work teams for long term success.

Hirina/Firing

The work teams should eventually be involved in the hiring and firing loop. After the proper training, they should interview prospective team members as well as recommend the dismissal of members from the team who are not up to par. This will allow the team to feel in control and maintain cohesiveness.

Compensation and Education

NASSCO should consider an incentive system for increased education. This type of system encourages team members to improve their skills and the flexibility of their team. Team members would receive a predetermined benefit each time they become proficient in a new skill or group of skills advantageous to the team. For example, the benefit can be increased seniority or extra pay. An incentive system rewards members who can perform more jobs on the team. It is up to the coaches and teams to make sure that members are using their new skills on the job so that they retain their new skills and the team benefits from their training.

Attendance

Due to a shared responsibility, group influence for performance is prevalent in work

teams. Once the teams take responsibility for their performance, attendance can be successfully handled through the team. The teams can arrange an attendance system which will allow members to miss work when necessary without unduly affecting the team's performance. For example, a member can inform the team on Monday that he/she will be absent on Friday. This will allow the team to plan ahead and cover the absent member's job. The team can also track attendance and recommend disciplinary action against members who abuse the system.

Job Security

During implementation, team members and coaches should be assured that the main purpose of work teams is to provide flexibility, improve productivity and make the company more competitive. Any work force reduction can be handled through normal attrition. If a further reduction is necessary when the teams mature, the teams can be involved in the decision. For example, the teams may decide to cut everyone's hours instead of initiating layoffs (Benson, 1991). A reduction in coaches will also be necessary in approximately two years when the teams become more self-reliant. If attrition does not provide the necessary reductions, assure the coaches that they can transfer elsewhere in the organization.

Work Team Deployment

Once On-Block has the initial design of their work teams, the department must decide how to make the change to work teams. On-Block should wait for the award of the first

ship of a three or more ship contract. Then, the department should go ahead with their current plan to restructure the department to work stations, but still operate with a trade orientated approach. The engineering and scheduling efforts that would support the work stations would also support the work teams. At the same time, technical support functions such as materials and engineering should be restructured, if considered necessary, in order to support the work stations. Cross-training can begin on the first ship provided that the current tradespeople will be remaining in the department when work teams are implemented. Also, the tradespeople should be required to perform their new skills on a regular basis in addition to their base trade skills in order to remain proficient in both areas. On the second ship, a phased-in conversion implementation strategy would involve the least amount of risk. initially, one work station could convert to work teams. Once they become proficient, the other stations could implement work teams. This would enable the On-Block Department to maintain a high productivity rate with the other work stations in order to offset a possible dip in productivity at the work team station. In addition, On-Block would have the ability to improve upon the work team design and make adjustments with the first team without affecting the whole department.

When the first work team is formed, On-Block will have to assign a degree of responsibility to the team. Total autonomy at the onset of work teams can lead to chaos since the team members are inexperienced at making business decisions. It is the coach's role to maintain control of this part of the implementation. At the beginning, the coach should still act as a supervisor, but begin teaching the team how the new system

will work. As the work team gets more orientated, the coach should begin to relinquish duties that the team can handle. For example, the team may begin to conduct their own meetings and make decisions on work methods and assignments. The coaches must not rush the teams into challenges before they are ready. It will probably take over two years for the teams to become completely self-directed.

Shipbuilding is unique and complex work. Coordinating all of the interdependent construction activities can be challenging. Therefore, self-directed work teams could be a valuable work structure for new construction outfitting as well as other areas in the shipyard. Inefficiencies, such as rework, which are due to environmental fluctuations, continue to be a problem in shipbuilding. The type of work systems required in shipbuilding must be flexible due to task complexity, the environment, and the workforce experience. Therefore, the employees should have control over their work since they are closer to the sources of uncertainty. Also, since shipbuilding is so labor intensive, increased employee involvement can improve efficiency through the coordination of interdependent tasks. Employee involvement can be in the form of work teams which can eventually improve shipbuilding work processes.

NASSCO can still benefit from a socio-technical analysis of the work systems. The analysis puts them in a better position to make improvements to the work process like restructuring to work stations. Of course, any organizational change imposes a risk. There are many researchers who have sound recommendations about socio-technical

systems and many companies, like NASSCO, who have tried work teams. NASSCO can minimize the risk of any work structure change, such as implementing work teams again, by using their experience as well as that of others to guide them.

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Appendix 1.

Team Readiness Survey

Question: When does it make sense to start work teams in your organization?

Answer: When the conditions are right.

To help you determine how conducive your organization is to the implementation of teams, you might want to give some thought to key situational issues. Using the scale below each item, give yourself a "5" for yes (if you strongly agree with the item) , a "1" for no (If you strongly disagree with the item) , or a "2","3", or "4" depending on how close you are to either end of the scale. When you are finished, total your scores for an indication of your organization's readiness to accept work teams.

1. Management believes that front-line employees can and should make the majority of decisions that affect how they do their work.

   1 2 3 4 5
   Strongly disagree Strongly agree

2. Employees can suggest and implement improvements to their work without going through several levels of approval.

   1 2 3 4 5
   Strongly disagree Strongly agree

3. The union is likely to agree to renegotiate traditional work rules and job classifications to permit greater flexibility and autonomy.

   1 2 3 4 5
   Strongly disagree Strongly agree

4. The nature of the work in your organization lends itself to a team-based approach rather than to individual effort.

   1 2 3 4 5
   Strongly disagree Strongly agree

5. Your technology is flexible enough to permit restructuring or reorganization based on the needs of your teams. The physical design of your workplace lends itself to working in teams.

1 2 3 4 5
Strongly disagree Strongly agree

6. It is possible to organize work so that teams of employees can take responsibility for entire jobs.

1 2 3 4 5
Strongly disagree Strongly agree

7. There is enough complexity in jobs to allow for initiative and decision making.

1 2 3 4 5
Strongly disagree Strongly agree

8. Your employees would be interested or willing to organize into teams.

1 2 3 4 5
Strongly disagree Strongly agree

9. Your overall organizational culture, vision, and values support teamwork and empowerment.

1 2 3 4 5
Strongly disagree Strongly agree

10. Your Organization has a history of following through on initiatives such as empowerment.

1 2 3 4 5
Strongly disagree Strongly agree

11. Management in your organization is willing to adjust responsibility downward and radically change its own roles and behavior.

1 2 3 4 5
Strongly disagree Strongly agree

12. Your company is secure enough to guarantee a period of relative stability during which the teams can develop.

1 2 3 4 5
Strongly disagree Strongly agree

13. You have adequate support functions, such as human resources, engineering, and maintenance, that can help teams by providing information, coaching and training.

Strongly disagree 1 2 3 4 5 Strongly agree

14. Management understands that developing teams is a lengthy, time consuming, and labor-intensive process. It is willing and able to make the investment.

Strongly disagree 1 2 3 4 5 Strongly agree

15. Your organization has systems that provide timely information to front-line employees.

Strongly disagree 1 2 3 4 5 Strongly agree

16. Your employees have the skills needed to take greater control of their jobs.

Strongly disagree 1 2 3 4 5 Strongly agree

17. YOU are willing to invest in training your front-line employees.

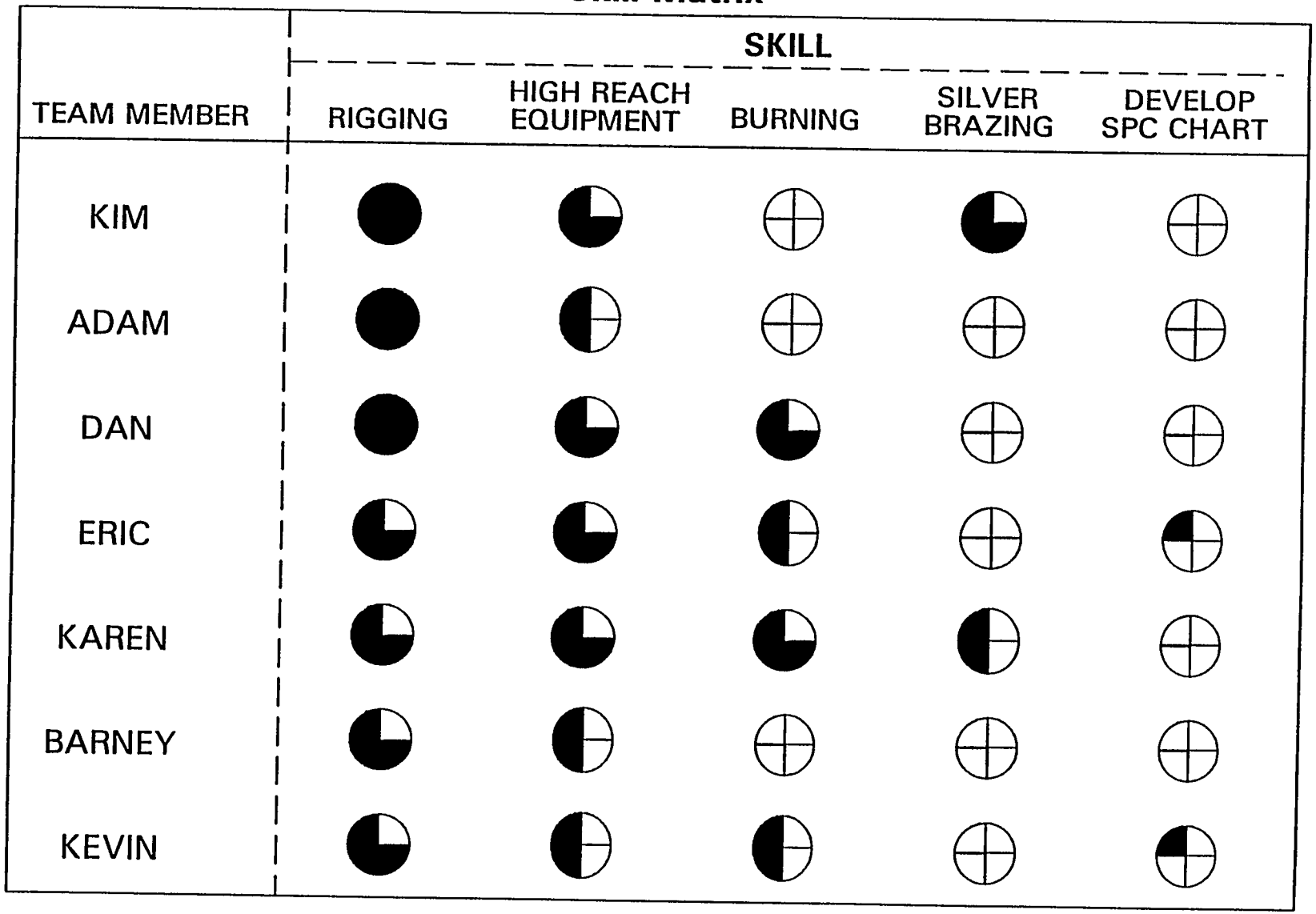
Strongly disagree 1 2 3 4 5 Strongly agree

Your Total Score:

Score	Actions
Above 65	You are on solid ground. Teams stand a good chance of taking root if properly implemented.
Between 40 & 64	There are some weaknesses in your culture's policies, processes, and procedures. Try to work on the weak areas before going ahead with a team implementation.
Below 40	Teams will have difficulty taking hold. You need to reexamine your culture and possibly explore a more gradual course toward empowerment before implementing self-directed teams.

"Scores/Actions are guidelines only. Questions do not carry equal weight in every organization.

Appendix 2.
Skill Matrix



Appendix3.

Sequential Steps for Effective Team Training

BEFORE TEAM START-UP

Time Frame	***Managers***, Group Leaders, & *Key Support* ***Members***	Team Leaders	Team members
12 mo before	Facilitated agreement on mission, vision, and values for the line	(Not yet selected)	(Not yet selected)
11 mo before	Project planning and implementation training		
10 mo before	Team-building activity Management team development planning		
8 mo before	Team-building activity		
6 mo before	Selection skills training Empowerment training Leadership and influence training		
5 mo before	Group leadership training	Orientation: ● Mission, vision, and values ● Role clarity ● Expectations and objectives ● Personal development planning ● Basic interaction skills training	
4.5 mo before	Developing organizational talent training (to agree on development plans for teem leaders)	Technical training on new equipment and processes, interspersed with team-building activities	
3 mo before	Encouraging initiatives training (to help team leaders actually implement an improvement.	Action skills training: ● Analyzing customer requirements ● Identifying root causes • Exploring alternatives ● Evaluating projects	
2.5 mo before	***-Joint Team-Building Activity-***		

Time Frame	Managers , Group Leaders, & Kev Support *Members*	Team Leaders	Team members
2 mo before		Selection skills training	
1 mo before		Facilitator training: ● Coaching ● Reinforcing	
3 weeks before		Job skills training	Orientation: •**Mission, vision, and** values ● Personal development planning •**Basics of working in** teams
2 weeks before		Leading meetings	Technical training on new equipment and processes, interspersed with basic interaction skills training
1 week before	*-Joint Team-Building Activity-*		
5 weeks after		Encouraging initiatives	Meetings skills : participating and leading
6 weeks after		(Team leaders deliver action skills training within their own teams)	Action skills training: analyzing customer requirements
1 weeks after			Action skills training: identifying root causes
8 weeks after		Valuing differences	Action skills training: exploring alternatives
9 weeks after			Action skills training: implementing improvements
9 to *14* weeks after		(Team leaders provide coaching and reinforcement)	(Team members actually implement their planned improvement)
14 weeks after			Action skills training: evaluating the project

Time Frame	Managers, Group Leaders, & Key Support Members	Team Leaders	Team members
16 weeks after		● Performance planning and feedback training (followed by actually setting process and results objectives) ● Team development and diagnosis	
4 mo after	***-Renewal Activity-***		
5 mo after 6 mo after	Leadership team assesses its performance	(Team leaders prepare to deliver additional training)	Gaining team agreement Assessing team Performance
1 year after	*-Renewal Activity-*		
1 year to 18 mo after			Team members start to pursue their own needs and interests: making presentations, budgeting, etc.
18 mo after	*-Refresher Training in Leadership SkillS-*		
18 mo to 2 years after		Team leaders support team members; prepare to deliver additional training	Refresher training in basic interaction skills, including handling conflict. influencing others, and supporting others
2 years after	*-Renewal Activity-*		

Appendix 4.

Work Team Questionnaire

Interviewer_____ Trade_____ Yrs. @ NASSCO

1. When did you join the On-Block work teams?

   a) At the beginning
   b) In the middle

2. The work team was a positive experience for me.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

3. The Coaches were helpful to the work team.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

4. I could influence how the work would be done.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

5. I learned problem solving skills as a result of the work teams.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

6. Other NASSCO Departments cooperated with the work teams (Engineering, Materials, Sandblast).

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

7. Strategy Meetings were an important part of work teams.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

8. The Union supported work teams.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

9. The training for work teams was adequate (cross training, problem solving, group dynamics)

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

10. Work teams handled problems and pressure better than individuals do.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

11. Work teams had full support from On-Block Management.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

12. Work teams improve workmanship and performance.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

13. The Coaches acted like a consultant/teacher more than they acted like a boss/foreman.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

14. Work teams could be successful at NASSCO today.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

15. As a team member, I was given opportunities to use my multi skills on the job.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

16. I took more pride in my work when I was work team member.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

17. The team could have functioned better or just as well with less supervisor direction and more worker responsibility.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

18. Work teams could override a decision that was made by facilitator.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

19. *Peer* pressure improved performance of individuals on the work team.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

20. I had enough time to adjust to my role as a work team member.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

21. I received both positive and corrective feedback on my productivity.

Strongly Agree	Somewhat *Agree*	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

22. Work teams reduced waiting time between trades.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

Appendix 5.

Work team tier survey results

SURVEY	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22
		QUESTION NUMBER																				
1	A	2	2	2	1	2	1	2	1	2	1	2	2	2	1	1	2	2	2	2	2	2
2	A	2	3	1	2	4	2	2	4	4	2	4	4	4	4	4	4	3	4	4	3	4
3	A	2	2	2	2	2	1	2	4	2	4	2	2	1	1	1	2	2	1	4	2	1
4	A	2	2	2	1	1	4	3	4	3	1	2	2	1	2	2	2	2	2	4	2	1
5	A	2	2	2	1	1	4	3	4	3	1	2	2	1	2	2	2	2	2	4	2	1
6	A	2	2	1	2	4	2	2	2	2	1	2	2	2	2	2	2	2	3	2	2	3
7	A	1	1	2	4	2	2	1	5	2	1	4	5	2	2	5	4	5	2	1	1	4
8	A	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	3	2	1	1	2
9	A	5	5	2	4	1	5	2	5	5	1	5	5	3	2	2	1	3	5	3	3	5
10	A	1	1	1	2	2	2	1	1	1	1	1	1	1	1	3	3	3	2	3	1	1
11	A	1	1	2	2	4	1	2	4	2	1	2	2	2	2	2	2	2	2	2	2	2
12	A	2	2	2	2	5	2	4	2	2	3	4	4	4	2	4	2	3	5	2	2	2
13	A	2	2	2	4	2	5	1	5	1	2	2	2	1	1	1	1	4	2	1	1	2
14	A	1	2	2	2	1	3	3	4	3	1	3	2	1	1	5	5	4	2	4	2	3
15	A	1	1	1	2	2	2	3	2	1	2	1	1	2	2	2	2	2	1	2	2	1
16	A	1	1	2	1	2	2	2	1	1	1	1	1	1	1	1	1	4	2	2	2	1
17	A	1	1	1	2	2	1	1	1	1	1	1	1	4	2	4	4	4	2	2	2	2
18	A	1	1	2	1	2	1	3	2	1	1	1	1	2	1	3	1	2	1	4	2	1
19	A	1	1	1	1	2	1	1	1	2	1	2	1	2	1	1	2	1	2	3	1	2
20	A	1	2	2	2	1	2	3	2	2	1	1	3	1	1	1	2	2	1	2	2	2
21	A	2	4	2	1	1	2	5	2	1	1	4	1	1	1	1	1	1	1	1	1	1
22	A	1	4	1	1	1	1	2	2	2	1	2	1	1	1	1	2	2	1	1	2	1
23	A	1	2	2	1	3	2	3	2	2	1	1	2	1	1	1	2	3	2	2	1	1
24	A	2	3	1	1	2	3	1	2	3	2	2	2	1	1	2	2	4	3	5	3	2
25	A	3	3	2	3	4	3	3	3	2	1	4	4	5	2	3	3	2	3	5	3	4
26	B	1	1	2	1	4	1	2	1	2	1	2	5	2	4	2	2	4	4	1	1	2
27	B	2	4	2	2	4	1	2	3	4	1	2	5	5	2	2	4	5	2	5	4	4
28	B	1	2	2	2	5	2	3	2	1	1	2	4	1	1	1	3	3	2	1	3	1
29	B	1	2	1	1	2	1	2	2	2	2	2	2	5	1	4	4	4	2	1	1	5
30	B	1	1	2	2	3	2	3	2	1	1	3	4	2	2	1	2	3	2	1	1	1
31	B	2	2	2	2	2	1	2	1	2	2	2	4	1	1	1	2	1	2	2	2	4
32	B	2	1	1	2	2	4	5	2	2	1	2	5	1	1	1	3	2	1	2	1	4
33	B	2	2	2	1	2	1	3	2	2	2	2	2	1	1	1	2	2	2	2	2	2
34	B	1	1	2	2	3	2	3	2	2	2	2	2	2	2	2	2	3	2	2	2	2
35	B	2	2	2	1	3	4	1	2	2	1	4	3	2	1	3	3	2	3	2	2	1
36	B	1	2	2	1	1	1	1	2	2	2	2	2	1	1	1	1	1	2	1	1	1
37	B	2	2	2	2	3	1	2	3	1	1	1	2	2	1	2	2	2	3	2	2	2
38	B	2	4	1	4	1	1	5	4	4	1	4	2	2	1	1	5	4	1	2	1	5
39	B	4	3	4	4	3	2	4	4	4	3	2	2	4	4	3	1	4	4	4	3	2
40	B	2	2	2	1	2	2	3	2	2	2	4	2	2	2	5	4	2	2	2	2	2
MEAN		1.67	2.05	1.75	1.85	2.35	2.02	2.42	2.5	2.1	1.42	2.32	2.52	2.02	1.57	2.12	2.42	2.22	2.4	1.87	2.22	
STNDRD DEV		0.84	1.02	0.58	0.96	1.15	1.15	1.11	2.22	0.99	0.70	1.08	1.32	1.23	0.83	1.26	1.09	1.07	1.01	1.24	0.74	1.27

Appendix 6.

Work Team Questionnaire

Work Team Members Survey Responses

StdDev	Question
	1. When did you join the On-Block work teams?
	25 a) At the beginning 15 b) In the middle
1.67 0.84	2. The work team was a positive experience for me.
	Strongly Agree (1) · Somewhat Agree (2) · No Response (3) · Somewhat Disagree (4) · Strongly Disagree (5)
2.05 1.02	3. The Coaches were helpful to the work team.
	Strongly Agree (1) · Somewhat Agree (2) · No Response (3) · Somewhat Disagree (4) · Strongly Disagree (5)
1.75 0.58	4. could influence how the work would be done.
	Strongly Agree (1) · Somewhat Agree (2) · No Response (3) · Somewhat Disagree (4) · Strongly Disagree (5)
1.85 0.96	5. I learned problem solving skills as a result of the work teams.
	Strongly Agree (1) · Somewhat Agree (2) · No Response (3) · Somewhat Disagree (4) · Strongly Disagree (5)

2.35
1.15

6. Other NASSCO Departments cooperated with the work teams (Engineering, Materials, Sandblast).

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.02
1.15

7. Strategy Meetings were an important part of work teams.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.42
1.11

8. The Union supported work teams.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.50
1.22

9. The training for work teams was adequate (cross training, problem solving, group dynamics)

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.10
0.99

10. Work teams handled problems and pressure better than individuals do.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

1.42
0.70

11. Work teams had full support from On-Block Management.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.38 12. Work teams improve workmanship and performance.
1.08

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.50 13. The Coaches acted like a consultant/teacher more than they acted like a
1.32 boss/foreman.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.02 14. Work teams could be successful at NASSCO today.
1.23

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

1.57 15. As a team member, I was given opportunities to use my multi skills on the job.
0.83

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.12 16. I took more pride in my work when I was work team member.
1.26

Strongty Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.40 17. The team could have functioned better or just as well with less supevisor direction
1.09 and more worker responsibility.

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.72 18. Work teams could override a decision that was made by facilitator.
1.07

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.22 19. Peer pressure improved performance of individuals on the work team.
1.01

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.40 20. I had enough time to adjust to my role as a work team member.
1.24

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

1.87 21. I received both positive and corrective feedback on my productivity.
0.74

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

2.22 22. Work teams reduced waiting time between trades.
1.27

Strongly Agree	Somewhat Agree	No Response	Somewhat Disagree	Strongly Disagree
1	2	3	4	5

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